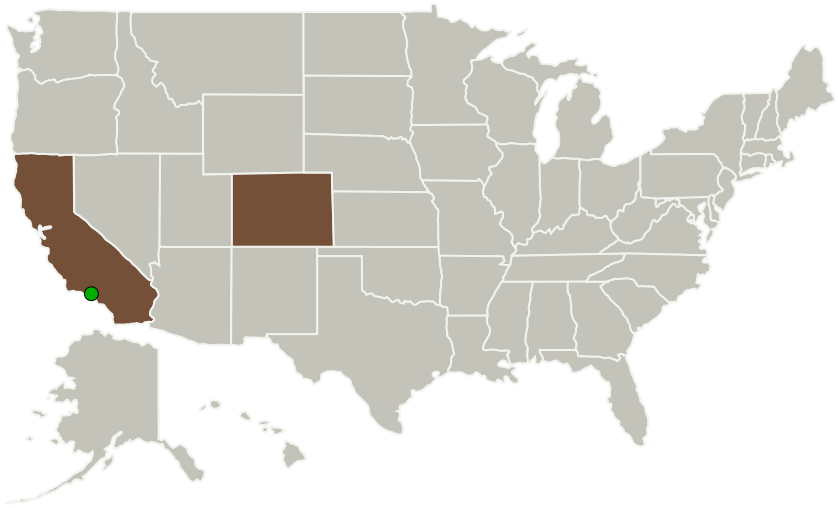
High-Flux Ultracold-Atom Chip Interferometers, Phase I

Completed Technology Project (2012 - 2012)

Project Introduction

ColdQuanta's ultimate objective is to produce a compact, turnkey, ultracold-atom system specifically designed for performing interferometry with Bose-Einstein condensates. To produce ultracold-atom-based devices (e.g. inertial sensors, magnetometers, clocks, etc.) that can compete with existing technologies, higher fluxes and/or faster production rates will be needed over current state-of-the-art techniques. In this Phase I work effort, ColdQuanta will address this need for greater fluxes by investigating two approaches toward developing high-flux compact BEC-producing systems. The first approach targets systems that utilize ColdQuanta's RuBECi vacuum cell and its proven success at the heart of the world's smallest, fastest-producing, ultracold atom systems. Using numerical optimization, we will improve the speed and efficiency (i.e. reduce atom loss) of several key production steps, including faster trap loading from a cold-atom source and more efficient atom transfer between magnetic traps. In the second, higher payoff approach, we will investigate implementation of assembly-line production of BECs using vacuum cell construction that allows each stage of production to occur simultaneously throughout a series of interconnected vacuum chambers. The resulting system would create ultracold atoms quasi-continuously and increase production rates by virtually eliminating dead time between sequential operating cycles.

Primary U.S. Work Locations and Key Partners



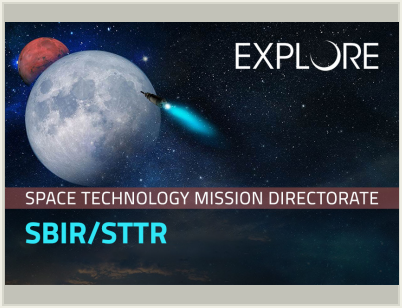


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Table of Contents

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Organizations Performing Work	Role	Type	Location
ColdQuanta, Inc.	Lead Organization	Industry	Boulder, Colorado
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Colorado

Project Transitions

February 2012: Project Start

August 2012: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140288)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

ColdQuanta, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Daniel M Farkas

Co-Investigator:

Daniel Farkas

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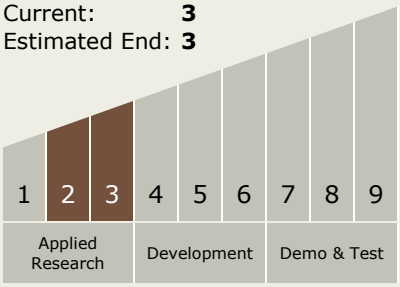
Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.1 In-Situ Resource Utilization
    - TX07.1.3 Resource Processing for Production of Mission Consumables

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System